

Kafr Shukr Eco-Bridge Design

Hussein Abbas

Faculty of engineering,
Al Azhar University,
Cairo, Egypt
habbas@ehaf.com

Abbas born 1943, received his B.Sc. Engineering, Ain Sham University, Cairo 1965, his Ph.D. from Paris University 1971.



Youssef Ghali

Architect
EHAF Consulting
Engineers
Cairo, Egypt
info@youssefghali.com

Youssef born 1979, received his Architecture degree from Faculty of Fine Arts, Cairo 2002



Abstract

The paper discusses a countryside eco-bridge designed to serve pedestrians and cattle in Kafr Shukr, which is a small village situated 80 kilometers away from Cairo. The daily rural activities of this village are split by a highway and an irrigation canal. As many other local villages, such situation forced the local farmers to risk crossing the road walking, after crossing the canal by ferries.

The bridge is composed of the following main elements:

- a) Two reinforced concrete ramps.
- b) Three concrete staircases for pedestrians use.
- c) Steel girder bridge.

This bridge is accessed by 2 concrete staircases and 2 ramps. At the side of the canal, the ramp is only 35m long, while the ramp at the opposite side is 95m long. The concrete ramps are sloped in the longitudinal direction by 1:15 or 6.65°, which can be considered acceptable, and hence suitable for the hardly predictable motion of cows whether single or grouped. A horizontal landing of few meters long is provided every 20 to 30m to enable the cattle to rest during their ascending or descending. The semi circular cross section of the ramps consists of 2 beams of 65cm width each and a height of 40cm, 15cm slab thick in between and an overlay fills of 25cm thick made of a soft walking surface suitable for animals. Two curved uprights of 120cm and 10cm thick are used as parapets.



Photomontage Showing the Bridge and the Access Ramp

Single inclined columns arranged in a staggered pattern support the two ramps composed of a number of segments. Every segment measures about 28m is carried on 10 tubular steel columns

slightly leaning in the longitudinal plane of the ramp. The leaning columns in two directions create an original visual dynamic expression.

Both ends of the bridge are supported on a sort of concrete abutments in the form of T-shape platforms; they act as access points that connect the deck with the staircases and the ramps, having curved corners they allow a smooth path for the users.

For the purpose of dynamic design, simplified rules have been adopted to formulate the vibration serviceability of the bridge. Among the rules and guidelines that have been considered in the design of the project are:

- The natural frequencies f should be in the range $1.6 \text{ Hz} < f < 2.4 \text{ Hz}$
- High tuning to f should be avoided $f > 3.4 \text{ Hz}$.

Frequency below 3.4 Hz is a safe limit, although difficult to achieve in practice.

The paper introduces an economical solution for an ecological problem, a bridge design that addresses simplicity and feasibility, with the least possible environmental impact. This bridge is more than a connection between two sides even though functionality and utility are prime concerns. Kafr Shukr eco-bridge combines function, economy and aesthetics.